## REMARKS

In the last Office Action, claim 5 was rejected under 35 U.S.C. §112, second paragraph as being indefinite because "the channel" should be --the first channel--. Claims 1-3 and 5-8 were rejected under 35 U.S.C. §103(a) as being unpatentable over US 2002/0125427 to Chand et al. ("Chand") in view of KR 2001-065673 to Hong et al. ("Hong") and JP 11-219680 to Ishitani et al. ("Ishitani"). Claims 4 and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Chand, Hong and Ishitani in view of US 6,177,670 to Sugiyama and US 5,482,802 to Celler et al. ("Celler").

In accordance with this response, claims 1-3, 5 and 7-9 have been amended in only formal respects to better conform the claim wording to U.S. practice and, in the case of claim 5, to overcome the indefiniteness rejection. New claims 10-20 have been added. The specification has been revised in editorial respects and to provide an antecedent basis for the claim language.

The present invention related to a method for manufacturing a split probe by channel processing a probe tip on a microcantilever. A drawback of the prior art method is the difficulty of determining the center or central part of the probe tip prior to channel processing, which is due to the fact that the imaging of the probe tip is taken from vertically above the probe tip. Typically, the radius of

curvature of the probe tip is 100nm or less, which makes it difficult to determine the true central part of the tip when viewed from directly above. As a consequence, the splitting of the probe tip by channel processing is oftentimes done at a position deviated from the true center of the tip.

In addition, in the conventional method, the channel processing is carried out using an ion beam current that is relatively large, which results in formation of a relatively large channel. Consequently, the distance between the divided tip parts of the probe tip is also made large, which is undesirable during use.

These and other drawbacks are overcome by the method of the present invention in which, in one aspect, the center or central part of the probe tip is accurately determined by imaging the tip not from directly above but from a position inclined with respect the probe tip. More particularly, in one embodiment of the invention, the cantilever is tilted or rotated relative to the irradiating direction of the focused ion beam that is used for imaging, which results in a more accurate and simpler determination of the center or central part of the probe tip. During imaging, a relatively low focused ion beam current is used, and the same level of focused ion beam current can also be used for channel processing the probe tip, which results in a satisfactorily narrow channel width. Thereafter, channel processing is

carried out using a focused ion beam current of larger value to cut through a conductive film that is formed on the cantilever surface and that electrically connects the probe to a wiring pattern, thereby electrically separating the split probe tip parts from one another.

In accordance with another aspect of the present invention, the channel processing of the probe tip is carried out in two stages. In the first stage, the channel section is formed in one side of the probe tip, then the cantilever is rotated 180 degrees relative to the irradiating direction of the focused ion beam, and another channel region is formed in the other side of the probe tip in a second state. The two channel regions intersect and connect with one another to split the probe tip into two probe tip parts.

No similar method is disclosed or suggested by the prior art.

The primary reference to Chand teaches a method for manufacturing a split probe by channel processing a probe tip on a microcantilever including the step of forming a split section by milling along the center of its length. As acknowledged by the Examiner, Chand does not disclose tilting the microcantilever, scanning the probe tip of the tilted microcantilever with a focused ion beam to obtain a SIM image of the probe tip and deciding a central position of the probe tip from the obtained SIM image.

Hong teaches tilting a microcantilever while milling a probe tip, but Hong does not teach providing a channel on the probe tip, tilting the microcantilever, scanning the probe tip of the tilted microcantilever with a focused ion beam to obtain a SIM image of the probe tip and deciding a central position of the probe tip from the obtained SIM image.

Ishitani teaches utilizing a focused ion beam to obtain a SIM image and determining a position for focused ion beam milling, but Ishitani does not disclose scanning and irradiating the probe tip of a tilted microcantilever with a focused ion beam to obtain a SIM image of the probe tip and deciding a central position of the probe tip from the obtained SIM image to process the central position.

None of Chand, Hong and Ishitani teaches obtaining a SIM image of a probe tip with the cantilever tilted and deciding a central position of the probe tip from the obtained SIM image to process the central position of the probe tip and, therefore, the combined teachings of these references would not have led one skilled in the art to the presently claimed method.

Independent claims 1, 8 and 9 each recite in one form or anther irradiating and scanning a probe tip on a microcantilever while the microcantilver is in a tilted state to obtain a SIM image of the probe tip, and deciding a central position of the probe tip based on the SIM image prior to

channel processing the probe tip. No such method is disclosed or suggested in the prior art references.

New independent claim 10 recites a method of manufacturing a split probe tip on a cantilever and includes the steps of irradiating and scanning a tip of the probe with a focused particle beam directed in a direction that is inclined relative to the surface of the cantilever to obtain an image of the probe tip, determining the center of the probe tip from the image of the probe tip, and forming a first channel in the probe tip at the center thereof by irradiating and scanning the center of the probe tip with a focused particle beam to form a split probe tip having two spaced-apart probe tip parts. The combined teachings of Chand, Hong and Ishitani do not teach or suggest obtaining an image of a probe tip prior to channel processing by irradiating and scanning a tip of the probe with a focused particle beam directed in a direction that is inclined relative to the surface of the cantilever on which the probe is formed to obtain an image of the probe tip, and determining the center of the probe tip from the image thereof, as recited in claim 10.

Dependent claims 11-20 recite other aspects of the inventive method, including the two-stage formation of the first channel, the different focused ion beam currents and a formation of a second channel in the probe that connects to

the first channel. These features are also not disclosed in the prior art references of record.

In view of the foregoing, the application is now believed to be in allowable form. Accordingly, favorable reconsideration and passage of the application to issue are respectfully requested.

Respectfully submitted,

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